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LAKE BASINS CREATED BY WIND EROSION.[1]

In various parts of the Great Plains lakelets are somewhat abundant. At the north some of them occupy hollows in the uneven surface of the drift; elsewhere they are imprisoned by the unequal heaping of sand in dunes.

Those of a third class are independent of drift and dunes, and their explanation is not so readily apparent. They are so shallow that one may wade across them in any direction. They have no outlets and no permanent inlets. Their catchment basins are small. Ordinarily their basins interrupt divides between stream valleys, and they often rest on the highest tables of their vicinity. They are not permanent, but appear and disappear as storm and drought alternately prevail. Some basins are ordinarily dry, holding water only for a few days or weeks after a thunder storm. The lakes of others are approximately perpetual, disappearing only after a succession of dry seasons.

During the summers of 1893 and 1894 I rode extensively through a district in the Arkansas basin where these lakes are somewhat abundant; in one rectangular tract containing less than 1000 square miles twenty were noted. Various hypotheses as to their origin were considered, and at the end of the first season wind action was preferred, but less because its process was understood than because each other suggested hypothesis seemed barred by some insuperable obstacle. In the second season, however, some allied phenomena were observed which seemed to throw light on the subject and served to strengthen the hypothesis of wind action.

The rocks of the country include a sandstone and two limestones which constitute the crests of the uplands, but the greater part of the surface is occupied by shales. The shales sustain a scanty growth of grass, with here and there a shrub and, more rarely, a few bush-like junipers. Their grade profiles are in general the typical products of subaërial degradation, convex upward on the divides and elsewhere gently concave. Interrupting these simple and familiar slopes there were found a few saucer-shaped cavities whose clean, smooth surfaces suggested at once their wind-swept character. They are almost wholly devoid of vegetation, and the shale from which they are carved is directly exposed without the intervention of residual or overplaced material. Three of them occupy a hillside sloping westward, so that the prevalent wind blows up hill. A part of the material excavated from these is deposited at their upper edges, and in the case of the individual most closely examined, has accumulated to such depth as to constitute a raised rim, deflecting the general drainage of the slope so that it passes around the hollow. The hollow itself is drained through several channels intersecting its lower edge. Rain and wind thus seem to be contesting for the mastery, and should the wind ever so deepen the saucer that it can contain without overflow the rain which falls upon it, a permanent lake basin may result. In another instance a small saucer is hollowed from an eastward slope, and here a clump of junipers standing at the lower edge has, by checking the wind, so aided the deposition of the detritus that the rim has been raised higher than the interior of the hollow and a temporary pool is the result. In yet another instance the hollow is carved on a southerly slope, and so deeply that it would pond the rainfall were it not tapped by a strong drainage line traversing the general slope at its eastern edge.

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[1] Read to the Geological Society of America, December 27, 1894.

In each case the normal slopes of the country are sharply interrupted by the features of the saucer, whose steep sides descend quickly to a relatively level bottom. The wind seems to have first swept out a few feet of disintegrated and residuary material, and then been checked by the firmness of the unweathered shale in which it can work no faster than the rock is disintegrated by frost and kindred agencies.

In four of the five instances the rock attacked is a dark shale which is naturally almost sterile, so that vegetation on its surface is exceptionally scanty unless it is coated by an overwash of other material. This relation suggests that the condition essential to the initiation of the excavation is the absence of vegetation. The function of vegetation as a defender of the soil against ravages of the wind is already familiar, and it is easy to understand that whenever a tract of land in an arid region is deprived by some accident of its vegetal covering, the wind may at once become an important factor in its sculpture, clearing away all disintegrated material and, if the tract is small, producing a hollow. If the hollow is so related to the slopes and drainage that it can gather water but will not be filled to overflowing, a permanent basin may result, for alternate flooding and drying will tend to keep the bottom of the hollow barren so that whenever it is dry the wind can continue its work. I believe the lake basins in question to have been created in this way.

In their present condition it is evident that they are naturally subjected to antagonistic processes dependent on the wind. While they contain water they receive dust from every gale that sweeps across the country, and the sediment thus accumulated, which is of no inconsiderable amount, tends, of course, to fill and thus obliterate them. When they are dry the wind resumes its erosive action and their bottoms are degraded. Professor Chamberlin has suggested an organic agency which also must constitute an important factor. In a region where springs and streams are rare the lakes are much resorted to by herds which, wading into the water to drink, carry away a coating of mud upon their feet and legs. The greater part of this mud is lost before they return, so that in this accidental way the beds of the lakes are steadily excavated and their margins enlarged. Horses and cattle sometimes increase their load by lying down in the mud, and their predecessor, the buffalo, is said to have the same habit.

With the pools called buffalo wallows I have little personal acquaintance, and I am not prepared to say whether their basins are initiated by the wind, or constitute an independent class with purely bovine origin. G. K. GILBERT.